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Abstract

Longleaf Pine (*Pinus palustris* Mills.) communities were once the most prevalent ecosystem in the Southeastern United States. Conversions of land to agricultural and urban uses and replacement of longleaf with other pine species following logging have drastically reduced the area occupied by longleaf pine. Although longleaf communities can still be found over most of its original range, it occupies less than 5 percent of its historical acreage. Much of this longleaf habitat is also highly fragmented occurring on small parcels of less than 50 acres. Private individuals own most ofhte remaining longleaf pine, except in Florida. The private sector is also where most of the losses in longleaf acreage have occurred over the last decade. Because of increasing prices, and the preponderance of sawtimber sized trees, potential harvests in the near future are likely to be quite high. If appropriate information and incentives are not in place, losses of longleaf from private lands could substantially increase.

Introduction

Longleaf pine (*Pinus palustris* Mill.) ecosystems once occupied perhaps as much as 60 million acres in the Southeastern Unites States (fig. 1), stretching from Southeastern Virginia south to central Florida west into eastern Texas (Stout and Marion 1993). These fire-dependent ecosystems covered a wide range of site condition, from low, wet flatwoods along the coast to dry mountain slopes and ridges in Alabama and northwest Georgia. Longleaf forest have been intensively exploited since colonial times, with little regard for regeneration. Intensive logging of the old-growth forest reached a peak shortly after the turn of the century (Ware and others 1993) and by 1935, only about 20 million acres of longleaf pine forest remained. The amount declined to 12 million acres by 1955 and to 3.8 million acres in 1985 (Kelly and Bechtold 1990).

Longleaf pine is the key tree species in a complex of fire-dependent ecosystems long native to the Southeastern United States. The continuing reduction of this important forest type treatens the myriad of life forms characteristic of, and largely dependent on, longleaf pine ecosystems. The diversity of ground cover plants per unit area places longleaf pine ecosystems amount the most species-rich plant communities outside the Topics. Extreme habitat reduction is the primary cause for the precarious state of at least 191 taxa of vascular plants (Hardin and White 1989). This situation concerns conservation and natural resources organizations throughout the South. A

committed effort to restore and manage longleaf pine ecosystems will help ensure its future in this Nation's natural heritage. This report is an assessment of the amount, location, ownership, and condition of the remaining longleaf ecosystem.

Methods

This report is based on information gathered by the Forest Inventory and Analysis units of the Southern Research Station, U. S. Department of Agriculture, Forest Service. The first broad-scale, objective inventories were conducted in the 1930's. The survey cycle, or time between repeat plot measurements, has averaged 6 to 8 years for the States with longleaf pine. Data fpr 1985 are adapted from Kelly and Bechtold (1990). Data for 1995 are from surveys completed as follows: Georgia, 1989 (Cheffield and Johnson 1993); Alabama, 1990 (McWilliams 1992); North Carolina, 1990 (Brown 1993); Louisiana, 1991 (Rosson 1995); Texas, 1992 (Miller and Hartsell 1992); South Carolina, 1993 (Conner 1993); Mississippi, 1994 (Hartsell and London 1995); and Florida, 1995 (Brown 1996).

These inventories were conducted on permanent sample plots systematically distributed across timberland to obtain a proportionate sample of all major forest types, sites, and ownership classes in the region. Each sample plot represented a specific number of equivalent acres of timberland from the entire population. This number, termed the expansion factor, had an average value of 3,500 acres for sample plots located in the longleaf pine forest type. Acreage totals in this report were obtained by summarizing the expansion factors for all plots where longleaf pine comprised more than 50 percent of the tree cover. At each sample location, a multipoint cluster plot was used to collect data on a representative sample of trees. Trees $\geq$ 5.0 inches in diameter were selected using a basel-area factor of 37.5 square feet per acre. Trees smaller than 5.0 inches were tallied on small, fixed plots that shared common point centers with each variable radius point center. Plot-level classifications used in the study were either computed or assigned in the field. Stocking-related items, such as forest type and stand size, were assigned in the field and verified during data editing and compiling for consistency with actual tree data collected. Variables such as site type and ownership were assigned during the data collection phase.

Results

Trends

The amount of longleaf pine has declined, from 3.77 million acres in 1985 (Kelly and Bechtold 1990) to 2.95 million acres in 1995. This is probably an over estimate because losses have occurred in some States since their previous inventories. The distribution of the remaining longleaf stands across the South was similar to the original longleaf range except for its elimination from northeastern North Carolina and Southeastern Virginia (fig. 2). The largest concentration of longleaf is in Okaloosa and Santa Rosa counties in the Florida panhandle and the adjacent Escambia county, Alabama (table 1). All of these counties had over 100,000 acres of longleaf pine in 1985, but survey results indicate a significant loss of longleaf acres in Santa Rosa county over the last decade.

The amount of longleaf pine on public lands had remained relatively stable from 1985 to 1995, with only North Carolina showing a small decline (fig. 3). Trends in longleaf area on forest industry lands were generally downward (fig. 4). Only Texas showed a small increase in longleaf pine acreage, while all the other States lost longleaf forest from industry lands. The area of longleaf on forest industry lands in North Carolina, Georgia, Florida and Mississippi declined by about 50 percent over the last decade. Overall, forest industry has lost 225,000 acres, which is 27 percent of the total decline in longleaf, however, occurred on privatenonindustrial lands (fig 5). All States except Mississippi show a decline in the amount of longleaf pine on private lands. Georgia, Florida, and Alabama lost over 100,000 acres of longleaf pine from private lands since 1985. The total acreage on private lands declined by 591,200 acres, which is 72 percent of the total decrease in area occupied by longleaf pine.

Current Conditions (1995)

Florida has the largest amount of longleaf pine remaining with nearly three quarters of a million acres or 25 percent of the total (fig. 6). Georgia and Alabama both contain 18 percent of the remaining longleaf acreage. Eight-five percent of the remaining longleaf was established by natural regeneration; 15 percent by planting. Nearly all planted stands are less than 40 yeat of age, while natural longleaf stands are predominantly 41 years of age and older (fig. 7). Forest industry owns 16 percent of the longleaf acreage (fig. 8). Public agencies control 33 percent of the longleaf acreage, while other private landowners consisting of individuals, farmers, and other corporations own 51 percent. Florida is unique because it is the only State where the public sector owns the largest amount of longleaf. The situation is reversed in Georgia, with very little longleaf on public lands. From 25 to 35 percent of the longleaf remaining in Florida, Georgia, South Carolina, and North Carolina occurs in stands of 20 acres of less (figs. 9-12). From 45 to 60 percent of all natural longleaf in these States is in stands of less than 50 acres. In Florida, most small stands of longleaf are in private ownership, while most stands over 100 acres are on public lands. Public ownership is also skewed toward the larger stands sizes in North Carolina.

About 60 percent of all longleaf stands are dominated by trees in the sawtimber size class (table 2). Florida and Georgia have considerable acreage in nonstocked status which are cutover lands that have regenerated poorly.

Recent survey have classed sample plots by site type. In North Carolina and South Carolina, distribution of longleaf is relatively equal between xeric and mesic sites (fig. 13). Longleaf in Georgia is primarily on mesic sites, with few longleaf acres on xeric sandhills. In Florida, most longleaf is growing on flatwoods sites, but a farily large amount occurs on xeric and mesic sites as well (fig. 13). Most natural stands of longleaf in Mississippi are on mesic sites. Longleaf pine acreage on mesic sites in Louisiana is about twice that on xeric sites. Few longleaf occur on hydric savanna sites in any State. Longleaf sites in Alabama and Texas were not classed by site type.

Discussion

The decline of the longleaf ecosystem will continue as more area is converted to other uses. Georgia seems particularly vulnerable because only a very small percentage of the longleaf ecosystem is on public lands. If we wish to maintain and, or restore critical portions of this habitat, we must first prioritize areas so efforts are expended on the best of most vital sites first.

Because of the longleaf ecosystem is made up of a number of different community types, a classification scheme will help organize these efforts. Craul and others[1] proposed a system based on climatic zones, which we have modified by splitting the Carolina zone into two parts (fig. 14). North Carolina has no inventory stands in the Sandhills or the Coastal Plain zones in the northern part of the State. In South Carolina, longleaf is well distributed in both zones. Longleaf distribution is good in the other zones with a number of sites in the Georgia Uplands, the Florida and Georgia Lowlands, the Alabama and Mississippi Lowlands, the Alabama mountains, and the Texas and Louisiana Coastal Plain. Thus, except for Virginia and northeastern north Carolina, a number of longleaf sites still exist in each of the broad longleaf zones.

Within each zone, ownership, stand size, stand age, and site type could be used to further refine prioritization of sites. Data on stand size reveal that much of the remaining longleaf occurs in small stands,

especially in privately owned areas. Because 75 percent of all longleaf grows in stands of less than 100 acres, the resource is becoming a very fragmented habitat. This fragmented highlights the importance
of maintaining the larger areas of longleaf concentration, such as exist in the panhandle area of Florida and adjoining Alabama.

The greatest needs and potential gains exit on private lands, which account for most of the remaining longleaf and most of the recent losses. The dominance of sawtimber-trees on these lands coupled with increasing sawtimber prices indicate a potential for significant harvest removals in the near future. If the proper information and incentives are unavailable when harvest occurs, losses of longleaf habitat on private lands could substantially accelerat3. Efforts, such as those in North Carolina that increase seedling supply and disseminate information on the potential returns from activities such as pinstraw production, foster the reestablishment of longleaf following harvest.

Although old-growth stands do exit, none were sampled by the inventory plots. The data indicate that few of the remaining sites have trees over 80 years old. Thus, maintaining any existing old growth and fostering the development of old growth should be a priority.

Data on site type indicate that Florida and Louisiana may have little longleaf on very wet areas. This situation needs further investigation to ensure that we are not

[1] Craul, P.J.; Croker, T.C.; Brendemuehl, R.H. 1965. Longleaf pine site zones. 58p Unpulished final report. On file with: Southern Research Station, Forestry Sciences Laboratory, 320 Green Street, Athens, GA 30602-2044.

losing out wet savanna areas because this specialized habitat has a large number of unique species.

The understory communities are also vital components of the longleaf pine ecosystem. However, the condition of these communities could not be obtained from current inventory data. We assumed that most longleaf pine plantations were established on sites previously cultivated or mechanically prepared, which severely reduces the native ground cover (Outcalt 1993, Outcalt and Lewis 1990). Thus, the understory of plantations is probably in poor condition.

The sites that regenerated naturally (85 percent) probably received little significant mechanical disturbance because longleaf rarely invades old field sites, and site preparation was minimal when using natural regeneration. Most longleaf on these sites probably originated from the seedfall of trees left after timber harvest operations. Although harvest operations can cause some damage to the understory, no species are eliminated and it recovers quickly. Therefore, initially the areas regenerated naturally should have had a largely intact understory component. A small number of these sites, primarily on military areas where activities frequently caused growing-season fires and on some national forest lands with an aggressive prescribed burning program, are currently in good condition. Most other sites contain longleaf communities where disruption of the natural fire regime has resulted in an increase in the size and density of the woody understory and concurrent decline in the herbaceous component.

The severity of the change in understory conditions depends on the site and fire history. Sandhills (xeric) sites are infertile and droughty. Thus, even in the absence of fire, the woody component increases relatively slowly. Many flatwoods sites have been periodically burned during the dormant season. Although this burning results in an increase in woody shrub density, it does prevent these shrubs from establishing a midstory layer. Periodic fires also maintain conditions open enough for the continued existence of most of the herbaceous component. On fertile upland (mesic) areas, the understory is probably much more degraded. Without fire, increased fertility leads to a rapid increase in woody growth. This results in a large increase in woody species and a subsequent loss or severe reduction of herbaceous species. Very wet sites also are in poor condition because they are too wet to burn most years. This results in the accumulation of large amounts of fuel, making the sites very difficult to prescribe burn. Therefore, most have not been burned; the woody component of the understory has become dominant; and very little of the herbaceous component remains.

Summary

The area occupied by longleaf pine, once the dominant tree species of the Southern Coastal Plains, has been drastically reduced over the last 200 years. In all States except Florida, the private sector is also where most of the losses in longleaf acreage occurred from 1985 to 1995. The potential for future losses is high because much of the longleaf controlled by the private nonindustrial owner is, or will soon reach, sawtimber size. Harvest levels will probably increase due to rising prices for this product. If we wish to reverse the loss

of longleaf, we must provide information and incentives to the private sector to encourage growing longleaf pine.

Although acreage in public ownership is relatively stable, other conditions need attention. Fortunately, most of the remaining longleaf pine originated from natural regeneration, much of the understory remains on these sites. More normal fire regines are needed, however, to improve the condition of the understory. Public lands will also have to provide most of the old-growth longleaf areas and the large contiguous blocks of longleaf type necessary for some species and landscape scale process.

Literature Cited

Brown, Mark J. 1993. North Carolina's forest 1990, Resour. Bull. SE-142. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station. 101 p.

Brown, Mark J. 1996. Forest statistics for Florida, 1995. Resour. Bull. SRS-6. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 48p.

Conner, Roger C. 1993, Forest Statistics for South Carolina, 1993. Resour. Bull. SE-141 Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station. 52p.

Hardin, E.D.; White, D.L. 1989. Rare vascular plant taxa associated with wiregrass (Aristida stricta) in the Southeastern United Station, Natural Area Journal. 9(4): 234-245.

Hartshell, Andrew J.; London, Jack D. 1995. Forest statistics for Mississippi count – 1994. Resour. Bull. SO-190. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 89p.

Kelly, J.F.; Beachtold, W.A. 1990. The longleaf pine resource, In: Proceedings of symposium on the management of longleaf pine; 1989 April 4-6; Long Beach, MS. Gen. Tech. Rep. SO-75. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station: 11-22.

McWilliams, William H. 1992. Forest Resources of Alabama, Resour. Bull. SO-170. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 71p.

Miller, Patrick E.; Hartsell, Andrew J. 1992. Forest statistics for east Texas Counties – 1992. Resour. Bull. SO-173. New Orleans, LA: U.S. Department of Agriculture. Forest Service, Southern Forest Experiment Station. 55p.

Outcalt, K.W. 1993. Wiregrass cover following site preparation of sandhills. In: Gjerstand, D.H., ed. Proceedings international conference on forest vegetation management; 1992 April 27-May 1; Auburn, Al., Auburn, Al: Auburn University School of Forestry Report 1993: 1, 198-201.

Outcalt, K.W.; Lewis, C.E. 1990. Response of wiregrass (Aristida stricta) to mechanical site preparation. I: Duever, L.C.; Noss, R.F., eds. Wiregrass biology and management, symposium proceedings; 1988 October 13; Valdosta, GA. Gainesville, FL: KBN Engineering & Applied Sciences. 12 p.

Rosson, James F., Jr. 1995. Forest resources of Louisiana, 1991. Resour. Bull. SO-192. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 71 p.

Sheffield, Raymond M.; Johnson, Tony G. 1993. Georgia's forest, 1989. Resour. Bull. SE-133. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station. 97 p.

Stout, I.J. ;Marion, W.R. 1993. Pine flatwoods and xeric pine forest of the southern (lower) coastal plain. In: Biodiversity of the Southeastern United Station: lowland terrestrial communities. Martin, W.H.; Boyce, S.G.; Echternacht, A.C., ed. New York: John Wiley. 373-446.

Ware, S.; Frost, C.; Doerr, P.D. 1993. Southern mixed hardwood forest: The Former longleaf pine forest. In: Biodiversity of the Southeastern United States: lowland terrestrial communities. Martin, W.H.; Boyce, S.G.; Echternacht, A.C., eds. New York: John Wiley. 447-493.

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Tables

The figures in the tables are based on sample plots and not a complete inventory. As with any sampling the probable error of the estimated mean increases as sample size decreases. Figures for individual counties have the largest sampling errors and are the least reliable. Estimates of sampling error are in the cited FIA references. Also some counties not listed do have small amounts of longleaf pine but, they have fallen below the threshold of detection.